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Proposal: CAN 86

19 September 1957

STATEMENT OF WORK
ADDED ENGINEERING WORK ON 3-CHANNEL
DATA-REDUCTION EQUIPMENT

The Contractor has had to supply added engineering, labor, facilities, and material to perform the following work, in addition to that previously proposed for the 3-Channel Data Reduction System for use with System 1:

1. Playback-Record Amplifier Redesign.

A basic redesign of plug-in amplifiers was undertaken to meet the requirement for the ultimate in signal-to-noise ratio, to extend the frequency response up to 100 kc, and to permit maximum flexibility in regard to playback and reproduction of signals from a variety of magnetic heads, and to operate with a variety of tape speeds.

It was thought, earlier, that hum could be eliminated by the use of a high-pass filter which sharply cuts off just above the hum frequencies; however, new information obtained from the field indicated the desirability of recording signal frequencies as low as 50 cps. Thus, the high-pass filter could not be used, and required removal of hum by more extensive redesign, a difficult thing to do because amplifier equalization required extremely high gain at just those frequencies at which hum appears. As a consequence, the playback-record amplifier was completely rebuilt, and has been refined to a point where it is now possible to observe tape noise 1 db in excess of amplifier noise, and the output hum is no greater than 10 db relative to combined tape and amplifier noise. This compares very favorably with the highest quality commercial recording equipment, while providing greater flexibility of operation.

The new amplifier configuration includes a shock-mounted mu-metal shielded preamplifier, shielded tubes, and provision for plug-in equalizers and input impedance-matching transformers. A low-pass filter, with 150 kc cut-off frequency, was incorporated to replace a tuned rejection filter used to eliminate the erase signal from the recording channel. A frequency response up to 100 kc represents an increase over the previous requirement of response to only 65 kc. This same amplifier is, of course, used with the 14-channel equipment.

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2. Monitor Unit Redesign.

The redesign of the playback-record amplifier, and the requirement for increased frequency response and signal-to-noise ratio necessitated rebuilding of the monitor unit. The frequency response of the VU meter was increased by the addition of a rectifier bridge circuit, to meet the new requirement for an increased frequency range. The erase amplifier in the monitor unit was modified to increase its power output, requiring the use of a new output transformer. To minimize hum pick-up, input and output circuits and connectors were redesigned, and ground return circuits were rearranged. Double shielded coaxial leads were incorporated for signal circuits, with quick-disconnect jacks. Increased filtering was added to the supply voltage circuits.

3. Mixer Unit Redesign.

To be compatible with the improved system performance provided by the redesigned amplifier and monitor, the mixer unit was redesigned to provide an increased dynamic range, and extended low frequency response, and shielding was added to chokes and filament transformers in the mixer power supply to reduce the generation of stray magnetic fields which induce hum voltages in low level circuitry. Increased shielding and circuit isolation was employed in the signal circuits to reduce interchannel crosstalk. The 1-kc rejection filter was modified to provide a wider pass band and a greater rejection ratio.

4. Transport Sequence Control Redesign.

Switching transients, whose level proved to be objectionable when attempting to achieve the very low noise-level required, were present, mixed with the signals passing through the playback-record amplifiers. To overcome these, a physical rearrangement of parts in the transport sequence control was necessary, with added shielding incorporated to prevent undesirable transfer of switching transients to signal circuits.

The voice-readout amplifier, whose output is mixed with one of the recording channels, had introduced stray signals. To prevent this, gating was employed to turn off the voice-readout amplifier during the long intervals when a voice

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number was not being recorded. Transient suppression filters were added to all relays in the system.

In order to facilitate operation, a voice-readout monitor jack was incorporated in the sequence control unit.

5. General Rack and System Modifications.

To minimize hum pick-up, units were rearranged in the C-rack, and cabling was redesigned in both A and C racks. Magnetic shielding was applied to tape-transport motors and additional shielding was applied to the Lipps head assembly. Cables from playback heads were rerouted within the racks, and ground-return circuits were considerably modified. Amplifier power supplies were modified to provide increased capacity, to improve their magnetic shielding, and to increase the filtering of their output voltages.

As a consequence of the redesigned units within the racks, intra-rack cabling was modified.

6. F-Rack Modifications.

Following the installation of moving styli in the F rack, field evaluation indicated the desirability of an improved fidelity of response. To achieve this, the moving-styli drive motor was replaced with one of greater power made by a different manufacturer, and the drive-motor amplifier was redesigned to provide greater power output. Signal-selection filters used in conjunction with fixed styli required added selectivity, which resulted in modification of these filters and a consequent modification of styli amplifiers to match the modified filters and to provide increased gain.

7. E-Rack Modifications.

Operation of the E rack with data recorded in the field indicated the need for a greater tolerance to pulse amplitude variations, and to variations in pulse shape which are introduced by the duping process. The new variations are in part due to changes in the frequency and phase response characteristics of the redesigned amplifiers in the playback equipment. Circuit changes were incorporated to overcome these problems. An increased rejection of the pulse-train

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carrying frequency information which appeared in the monitor output was provided. It had not been sufficiently attenuated previously. The 1 kc reference tone which appeared on channel 1 was filtered out of the signal appearing in the monitor output, and the monitor amplifier in the E rack was modified accordingly.

8. Manual Revision.

Extensive revision of the instruction guide was required to incorporate the engineering changes and modifications made to the equipment.

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